SERVICE MANUAL

VHF MARINE TRANSCEIVER

IC-M45A

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-M45A** VHF MARINE TRANSCEIVER at the time of publication.
2 versions of the **IC-M45A** have been designed. This service manual covers each version.

MODEL	VERSION	SYNBOL
IC-M45A	USA	BLACK
	USA-1	WHITE

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 16 V. This will ruin the transceiver.
DO NOT expose the transceiver to rain, snow or any liquids.
DO NOT reverse the polarities of the power supply when connecting the transceiver.
DO NOT apply an RF signal of more than 20 dBm (100mW) to the antenna connector. This could damage the transceiver's front end.

ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:
1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<**SAMPLE ORDER**>

1110003490 S.IC TA31136FN IC-M45A MAIN UNIT 5 pieces
8810008660 Screw PH BO M3x8 NI IC-M45A Chassis 10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTES

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated turning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 40 dB to 50 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.

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SECTION 1 SPECIFICATIONS

■ GENERAL

- Frequency coverage : 156.025–157.425 MHz (Tx)
  156.025–163.275 MHz (Rx)
- Mode : 16K0G3E (FM)
- Usable channels : All USA, international and Canadian channels plus 10 weather channels
- Power supply requirement : 13.8 V DC ±10 % (negative ground)
- Usable temperature range : –20˚C to +60˚C; –4˚F to +140˚F
- Frequency stability : ±10 ppm (–20˚C to +60˚C; –4˚F to +140˚F)
- Current drain (at 13.8 V DC) : Transmit at 25 W 6.0 A
  Receive max. audio 1.2 A
- Antenna impedance : 50 Ω (nominal)
- Dimensions (projections not included) : 152(W)×67(H)×144(D) mm; 6(W)×2⅝(H)×5⅔(D) in
- Weight (with ant., battery case and cells) : 900 g; 2 lb

■ TRANSMITTER

- Output power (at 13.8 V DC) : High 25 W
  Low 1 W
- Modulation : Variable reactance frequency modulation
- Maximum frequency deviation : ±5.0 kHz
- Spurious emissions : 70 dB
- Adjacent channel power : 60 dB
- Residual modulation : 40 dB
- Audio harmonic distortion : Less than 10% at 70% deviation
- Audio frequency response : +1 dB to –3 dB of 6 dB octave from 300 Hz to 3000 Hz

■ RECEIVER

- Receive system : Double conversion superheterodyne system
- Intermediate frequencies : 1st 21.7 MHz
  2nd 450 kHz
- Sensitivity : 0.32 µV typical at 12 dB SINAD
- Squelch sensitivity : 0.32 µV typical
- Adjacent channel selectivity : 70 dB typical
- Spurious response : 70 dB typical
- Intermodulation rejection ratio : 70 dB typical
- Hum and noise : 40 dB
- Audio output power (at 13.8 V DC) : 4.0 W typical at 10% distortion with an 4 Ω load
- Audio frequency responce : +2 dB to –8 dB of –6 dB octave from 300 Hz to 3000 Hz

All stated specifications are subject to change without notice or obligation.

■ VHF MARINE CHANNEL LIST

Channel No.			Frequency (MHz)		Channel No.			Frequency (MHz)		Channel No.			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive	USA	INT	CAN	Transmit	Receive	USA	INT	CAN	Transmit	Receive
	01	01	156.050	160.650	21A		21A	157.050	157.050	73	73	73	156.675	156.675
01A			156.050	156.050		22		157.100	161.700	74	74	74	156.725	156.725
	02	02	156.100	160.700	22A		22A	157.100	157.100	77*1	77	77*1	156.875	156.875
	03	03	156.150	160.750		23	23	157.150	161.750		78		156.925	161.525
03A			156.150	156.150	23A			157.150	157.150	78A		78A	156.925	156.925
	04		156.200	160.800	24	24	24	157.200	161.800		79		156.975	161.575
		04A	156.200	156.200	25	25	25	157.250	161.850	79A		79A	156.975	156.975
	05		156.250	160.850	26	26	26	157.300	161.900		80		157.025	161.625
05A		05A	156.250	156.250	27	27	27	157.350	161.950	80A		80A	157.025	157.025
06	06	06	156.300	156.300	28	28	28	157.400	162.000		81		157.075	161.675
	07		156.350	160.950		60	60	156.025	160.625	81A		81A	157.075	157.075
07A		07A	156.350	156.350		61		156.075	160.675		82		157.125	161.725
08	08	08	156.400	156.400	61A		61A	156.075	156.075	82A		82A	157.125	157.125
09	09	09	156.450	156.450		62		156.125	160.725		83	83	157.175	161.775
10	10	10	156.500	156.500			62A	156.125	156.125	83A		83A	157.175	157.175
11	11	11	156.550	156.550		63		156.175	160.775	84	84	84	157.225	161.825
12	12	12	156.600	156.600	63A			156.175	156.175	84A			157.225	157.225
13*2	13	13*1	156.650	156.650		64	64	156.225	160.825	85	85	85	157.275	161.875
14	14	14	156.700	156.700	64A		64A	156.225	156.225	85A			157.275	157.275
15*2	15*1	15*1	156.750	156.750		65		156.275	160.875	86	86	86	157.325	161.925
16	16	16	156.800	156.800	65A	65A	65A	156.275	156.275	86A			157.325	157.325
17*1	17	17*1	156.850	156.850		66		156.325	160.925	87	87	87	157.375	161.975
	18		156.900	161.500	66A	66A	66A*1	156.325	156.325	87A			157.375	157.375
18A		18A	156.900	156.900	67*2	67	67	156.375	156.375	88	88	88	157.425	162.025
	19		156.950	161.550	68	68	68	156.425	156.425	88A			157.425	157.425
19A		19A	156.950	156.950	69	69	69	156.475	156.475					
20	20	20*1	157.000	161.600	70*3	70*3	70*3	156.525	156.525					
20A			157.000	157.000	71	71	71	156.575	156.575					
	21	21	157.050	161.650	72	72	72	156.625	156.625					

*1 Low power only, *2 Momentary high power, *3 Receive only

NOTE: Channels 3, 21, 23, 61, 64, 81, 82 and 83 **CANNOT** be used by the general public in USA waters.

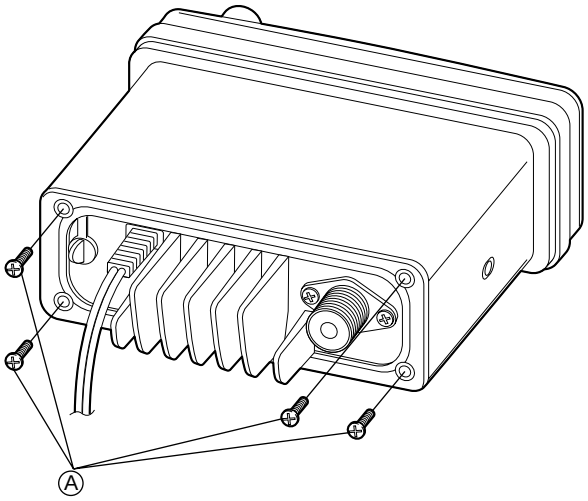
Weather channel	Frequency (MHz)		Weather channel	Frequency (MHz)	
	Transmit	Receive		Transmit	Receive
WX01	Receive only	162.550	WX06	Receive only	162.500
WX02	Receive only	162.400	WX07	Receive only	162.525
WX03	Receive only	162.475	WX08	Receive only	161.650
WX04	Receive only	162.425	WX09	Receive only	161.775
WX05	Receive only	162.450	WX10	Receive only	163.275

SECTION 2 DISASSEMBLY INSTRUCTIONS

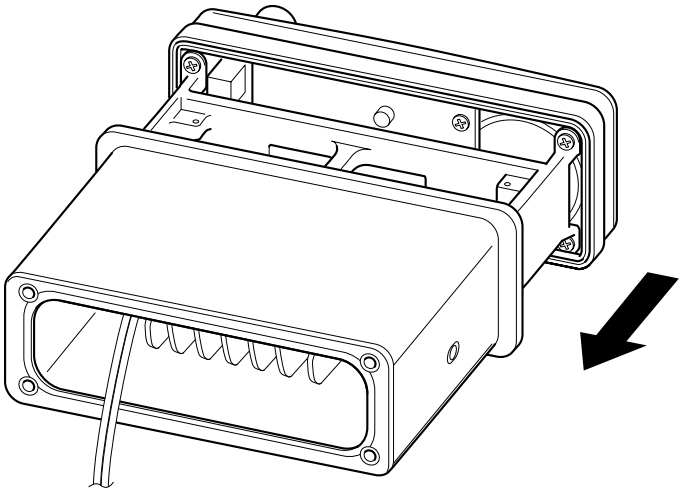
• REMOVING THE CASE

① Unscrew 4 screws, Ⓐ.

Note: When replacing the screw, 10 –12 kg of torque MUST be applied to ensure water resistance.



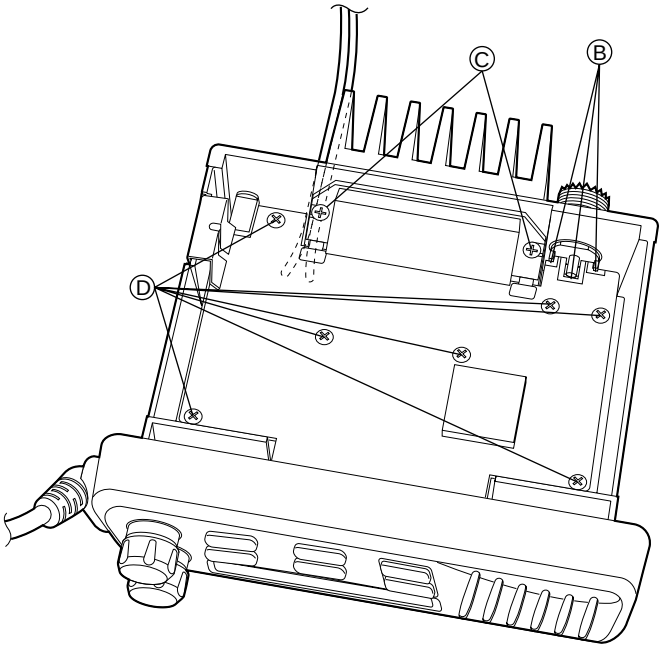
② Slide the case free of the chassis in the direction of the arrow.



• REMOVING THE MAIN UNIT

① Unsolder DC cable (2 points) and antenna connector, Ⓑ (3 points), as shown below.

② Unscrew 2 screws, Ⓒ, and 7 screws, Ⓓ, to remove the MAIN unit.



SECTION 3 CIRCUIT DESCRIPTION

3-1 RECEIVER CIRCUITS

3-1-1 ANTENNA SWITCHING CIRCUIT

The antenna switching circuit functions as a low-pass filter while receiving and as resonator circuit while transmitting. The circuit does not allow transmit signals to enter receiver circuits.

Received signals enter the MAIN unit from the antenna connector and pass through the low-pass filter (L1, L2, C1–C3). The signals are then applied to the RF circuit via the antenna switching circuit (C7, C8, D1, D19, L3).

3-1-2 RF CIRCUIT

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The signals from the antenna switching circuit pass through a tunable bandpass filter (C10, C12, C13, D2, L4) where the object signals are led to the RF amplifier circuit (Q1).

The amplified signals at Q1 are applied to the 2-stage tunable bandpass filter (C20, C22, C24, C26, D3, D4, L5, L6) to suppress unwanted signals and improve the selectivity. The signals are then applied to the 1st mixer circuit.

D2–D4 employ varactor diodes, that are controlled by the PLL lock voltage, to track the band pass filters.

3-1-3 1ST MIXER AND 1ST IF CIRCUITS

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a 1st LO (VCO output) frequency. By changing the 1st LO frequency, only the desired frequency will be passed through a pair of crystal filters at the next stage of the mixer.

The signals from the RF circuit are mixed with the VCO signals at the 1st mixer circuit (Q2) to produce a 21.7 MHz 1st IF signal.

The 1st IF signal is applied to a pair of crystal filters (FI1 and FI3) to suppress out-of-band signals and is then amplified at the IF amplifier (Q3). The amplified signal is applied to the 2nd mixer circuit (IC2, pin 16).

3-1-4 2ND IF AND DEMODULATOR CIRCUITS

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

The FM IF IC (IC2) contains the 2nd local oscillator, 2nd mixer, limiter amplifier, quadrature detector, and noise detector circuits, etc.

The 1st IF signal from Q3 is applied to the 2nd mixer section of IC1 (pin 16), and is mixed with a 25.25 MHz 2nd LO signal generated at the PLL circuit (IC3, pin 17) to produce a 450 kHz 2nd IF signal.

The 2nd IF signal from IC2 (pin 3) is passed through the ceramic filter (FI2), where unwanted signals are suppressed, and is then applied to the 2nd IF and limiter amplifiers in IC2 (pin 5). The signal is applied to the FM detector section in IC2 for demodulation into AF signals.

The FM detector circuit employs a quadrature detection method (linear phase detection), which uses a ceramic discriminator (X1) for phase delay to obtain a non-adjusting circuit. The detected signal from IC2 (pin 9) is applied to the AF circuit.

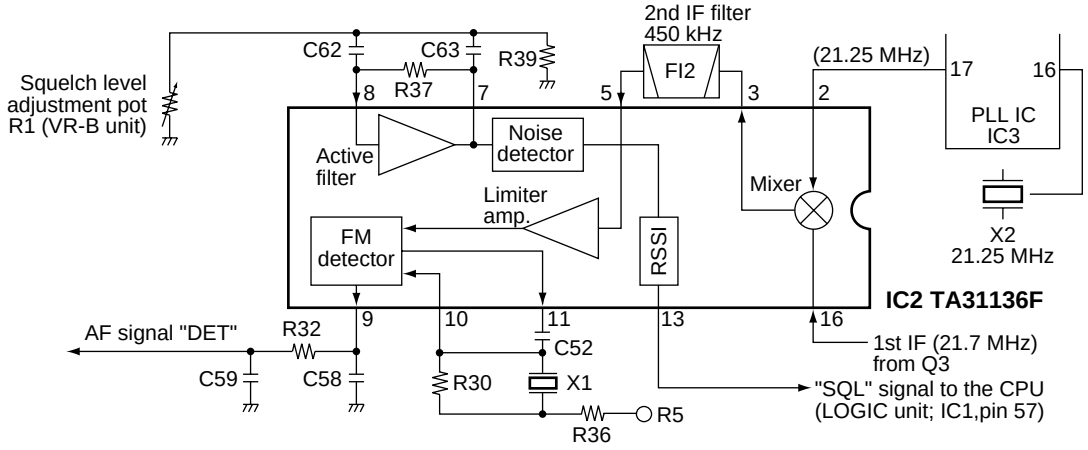
3-1-5 AF AMPLIFIER CIRCUIT

The AF amplifier circuit amplifies the detected signals to drive a speaker. The AF circuit includes an AF mute circuit for the squelch.

AF signals from IC2 (pin 9) are applied to the de-emphasis circuit (R116, C182). The de-emphasis circuit is an integrated circuit with frequency characteristic of –6 dB/octave, and then the integrated signals are applied to the AF amplifier (Q23).

The amplified signals are passed through the [VOLUME] control (VR-A unit; R1), and are then applied to the AF power amplifier (IC7, pin 1) via the analog switch (Q24). The output signal from IC7 (pin 4) drives the internal (external) speaker.

• 2nd IF AND DEMODULATOR CIRCUITS



3-1-6 SQUELCH CIRCUIT

A squelch circuit cuts out AF signals when no RF signals are received. By detecting noise components in the AF signals, the squelch circuit switches the AF mute switch.

A portion of the AF signals from the FM IF IC (IC2, pin 9) pass through the [SQUELCH] control pot (VR-B unit; R1) via the "SQLI" signal, and are then applied to the active filter section (IC2, pin 8). The active filter section amplifies and filters noise components. The filtered signals are applied to the noise detector section and output from pin 13 as the "SQL" signal. The "SQL" signal is applied to the CPU (LOGIC unit; IC1, pin 57). The CPU analyzes the noise condition and outputs the "RMUT" signal to an AF mute switch(Q24).

3-1-7 WEATHER ALERT DECODER CIRCUIT [USA version only]

When the weather alert function is activated and a 1050 Hz alert tone from an NOAA weather radio broadcast is received, the IC-M45A emits beep tones and indicates flashing "ALT" on the display to inform of an emergency weather report on the air.

AF signals from the FM IF IC (IC2, pin 9) are applied to the tone decoder (IC1, pin 3). When a 1050 Hz signal is detected, the tone decoder outputs a low level signal from pin 8 and the output signals are applied to the CPU (LOGIC unit; IC1, pin 41) to control beep tones and the "ALT" indicator.

3-2 TRANSMITTER CIRCUITS

3-2-1 MICROPHONE AMPLIFIER CIRCUIT

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis from the microphone to a level needed at the modulation circuit.

The AF signals from the microphone are amplified at the microphone amplifier (IC5). A capacitor (C138) and resistor (R89) are connected to the microphone amplifier (IC5) to obtain the pre-emphasis characteristics.

The amplified signals are passed through the splatter filter (IC5) to suppress unwanted 3 kHz or higher signals. The filtered signals are then applied to the modulation circuit.

3-2-2 MODULATION CIRCUIT

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signals.

Audio signals from the splatter filter (IC5) pass through the frequency deviation adjustment pot (R106) and are then applied to the modulation circuit to modulate the oscillated signal at the VCO (Q7).

3-2-3 DRIVE AMPLIFIER CIRCUIT

The drive amplifier circuit amplifies the VCO oscillating signal to a level needed at the power amplifier.

The VCO output is buffer-amplified by Q8 and Q10, and is then applied to the T/R switch (D11). The transmit signal from the T/R switch is amplified to the pre-drive (Q11) and drive (Q12) amplifiers to obtain an approximate 300 mW signal level. The amplified signal is then applied to the RF power amplifier (IC4, pin 1).

3-2-4 POWER AMPLIFIER CIRCUIT

The power amplifier circuit amplifies the driver signal to an output power level.

IC4 is a power module which has amplification output capabilities of about 35 W. The output from IC4 (pin 4) is passed through the antenna switching circuit (D19) and is then applied to the antenna connector via the low-pass filter (C1–C3, C5, C6, L1, L2).

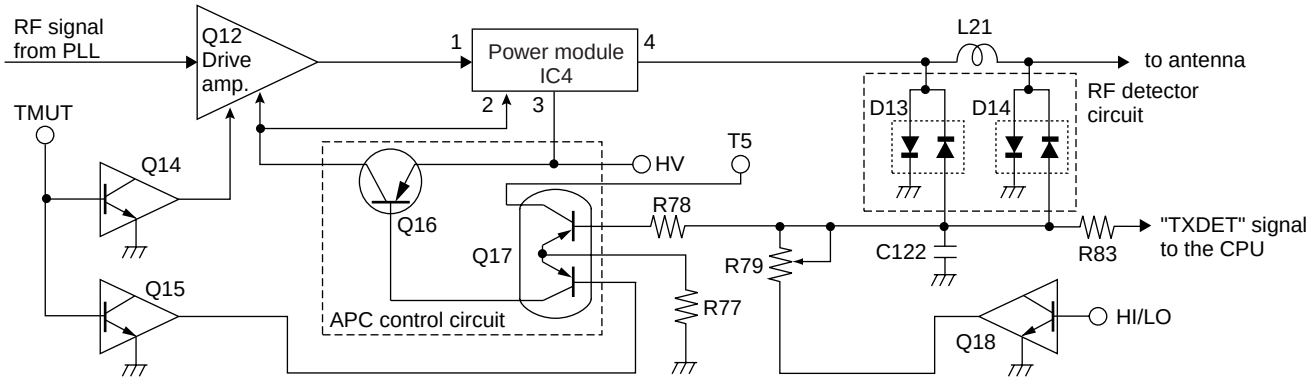
3-2-5 APC CIRCUIT

The APC circuit stabilizes transmit output power.

The RF output signal from the power amplifier (IC4, pin 4) is detected at the power detector circuit (D13, D14, L21) and is then applied to one of the differential amplifier inputs (Q17, pin 5) via the High/Low control circuit (Q18, R79). The applied voltage controls the differential amplifier output (Q17, pin 2) and the bias voltage control (Q16). Thus the APC circuit maintains a constant output power.

The reflected power from the antenna connector is detected at D14 and is then applied to the CPU (LOGIC unit; IC1, pin 45). The detected voltage increases when the antenna is mismatched, causing the output power to be switched from High to Low to protect the power module (IC4).

• APC circuit



3-3 PLL CIRCUITS

3-3-1 GENERAL

The PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL circuit compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by a crystal oscillator and the divided ratio of the programmable divider.

The PLL circuit , using a one chip PLL IC (IC3), directly generates the transmit frequency and receive 1st IF frequency with VCOs. The PLL sets the divided ratio based on serial data from the CPU on the LOGIC unit and compares the phases of VCO signals with the reference oscillator frequency. The PLL IC detects the out-of-step phase and output from pin 13. The reference frequency (21.25 MHz) is oscillated at X2.

3-3-2 TX AND RX LOOP

The generated signal at the VCO (C70, C74, L12, D6, D7, Q7) enters the PLL IC (IC3, pin 19) and is divided at the programmable divider section and is then applied to the phase detector section.

The phase detector compares the input signal with a reference frequency, and then outputs the out-of-phase signal (pulse-type signal) from pin 13.

The pulse-type signal is converted into DC voltage (lock voltage) at the loop filter (C67, C79, R55, R56), and then applied to variable capacity diodes (D6, D7) of the VCO to stabilize the oscillated frequency. The lock voltage is also used for the receiver circuit for the bandpass filter center frequency. The lock voltage from the loop filter is amplified at the buffer-amplifier (Q8, Q10) and then applied to the RF circuit.

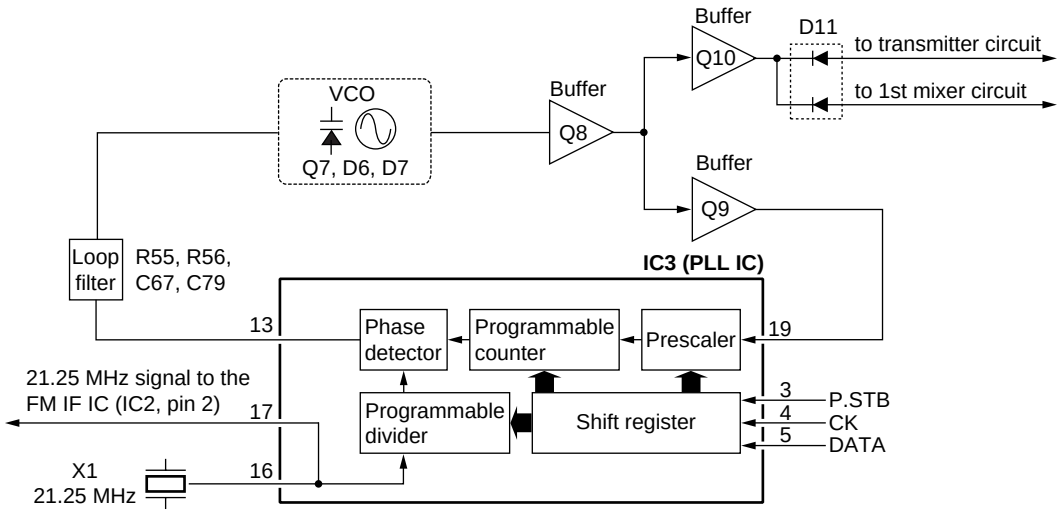
3-3-3 VCO CIRCUIT

The VCO outputs from Q7 are buffer-amplified at Q8 and Q10, and are then sent to the T/R switch (D11). The receive LO signal is applied to the 1st mixer circuit (Q2) through a low-pass filter, and the transmit signal is applied to the predrive amplifier (Q11). A portion of the VCO output is reapplied to the PLL IC (IC2, pin 2 or pin 19) via Q9.

3-4 POWER SUPPLY CIRCUITS

LINE	DESCRIPTION
HV	The voltage from the connected DC power supply.
HVS	Same voltage as the HV line which is passed through the [PWR] switch (VR-A unit; R1).
5V	Common 5 V converted from the HVS line at the 5V regulator circuit (IC6).
R5	Receive 5 V converted from the 5V line at the R5 regulator circuit (Q21, Q22). The regulated voltage is applied to the receiver circuits.
T5	Transmit 5 V converted from the 5V line at the T5 regulator circuit (Q19, Q20).

• PLL circuit



3-5 PORT ALLOCATIONS

3-5-1 CPU (LOGIC unit; IC1)

Pin number	Port name	Description
41	TONE	Input port for the weather alert tone decode signal. Low : Weather alert tone (1050 Hz) is detected.
42	UNLK	Input port for the PLL unlock signal. Low : While PLL is locked.
43	LBATT	Input port for the connected power supply voltage detection (low battery indicator).
44	PTT	Input port for the PTT switch.
45	TXDET	Input port for the “TX” indicator from the power detector circuit (Main unit; D13, D14).
46	SQLV	Input port for the squelch volume level.
47	KEY.M	Input port for the smart mic functions. 2.02 V: [UP] is pushed 3.00 V: [DN] is pushed 3.84 V: [HI/LO] is pushed
49, 50	LAMP2, LAMP1	Outputs LCD backlight control signal. High : While LCD backlight is ON.
51	H/L	Output port fo RF output power (High or Low) select signal. Low : While low power is selected
53	BEEP	Outputs beep audio signals.
56	ESI	Input port for the data signals from the EEPROM (IC2, pin 1).
57	SQL	Input port from the FM IF IC (MAIN unit; IC2, pin 13) for the squelch operation. Low : While signal receiving.
62	P.STB	Outputs strobe signals for the PLL circuit.
64	DATA	Outputs data signals to the EEPROM (IC2, pin 5), PLL and IC (MAIN unit; IC5).
63	CK	Outputs clock signal to the EEPROM (IC2, pin 6) and PLL IC (MAIN unit; IC3, pin 4).
65	TMUT	Outputs transmit mute signal. Low : While transmitting
66	RMUT	Outputs the analog switch (MAIN unit; Q24) control signal. Low : While squelched
75	SEND	Outputs the T5 regulator (MAIN unit; Q19, Q20) control signal. Low : While transmitting
76	RCV	Outputs the R5 regulator (MAIN unit; Q21, Q22) control signal. Low : While receiving

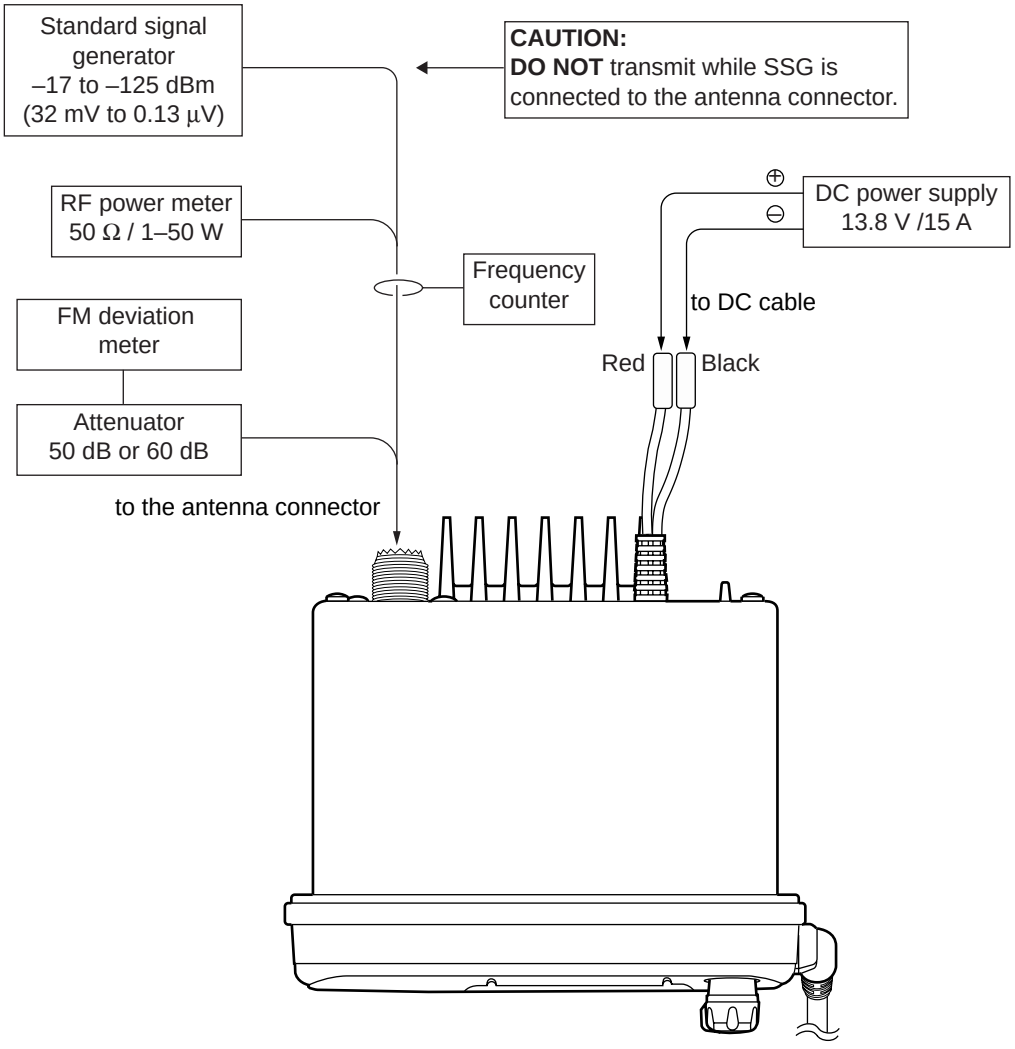
SECTION 4 ADJUSTMENT PROCEDURES

4-1 PREPARATION

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.8 V DC Current capacity : 10 A or more	Audio generator	Frequency range : 300–3000 Hz Measuring range : 1–500 mV
RF power meter (terminated type)	Measuring range : 1–50 W Frequency range : 100–300 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Standard signal generator (SSG)	Frequency range : 0.1–300 MHz Output level : 0.1 μV–32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–300 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V
FM deviation meter	Frequency range : 30–300 MHz Measuring range : 0 to ±10 kHz	AC millivoltmeter	Measuring range : 10 mV–10 V
DC voltmeter	Input impedance : 50 kΩ/V DC or better	External speaker	Input impedance : 4 Ω Capacity : 5 W or more
		Attenuator	Power attenuation : 50 or 60 dB Capacity : 50 W or more

■ CONNECTIONS



4-2 PLL ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1	• Operating channel : ch16 • Receiving	MAIN	Connect a digital multi-meter or oscilloscope to the check point CP1.	2.6 V	MAIN	L12
REFERENCE FREQUENCY	1	• Operating channel : ch16 • Output power : Low • Connect an RF power meter or a 50 Ω dummy load to the antenna connector. • Transmitting	Rear Panel	Loosely couple the frequency counter to the antenna connector.	156.800000 MHz	MAIN	C85

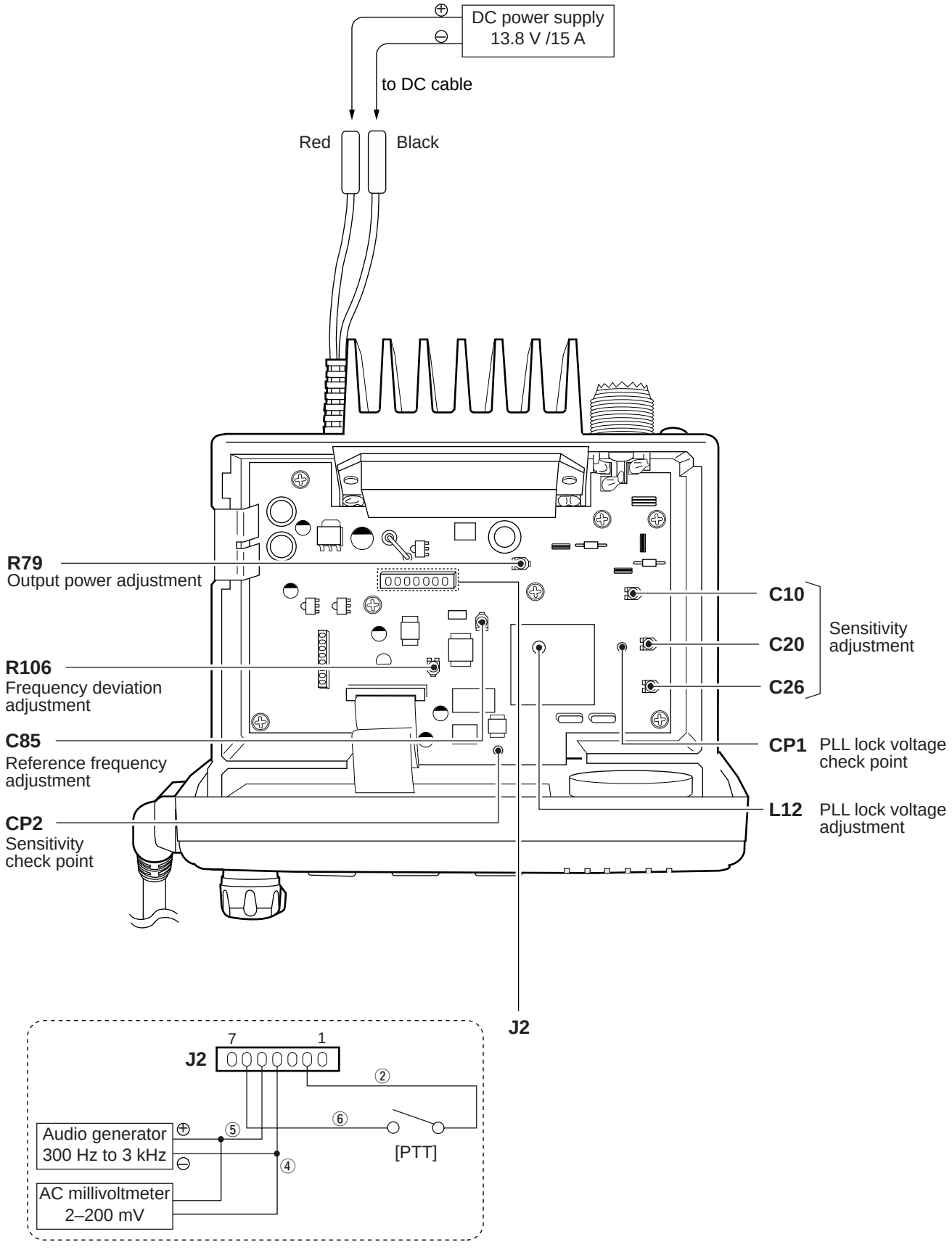
4-3 TRANSMITTER ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1	• Operating channel : ch16 • Output power : High • Transmitting	Rear Panel	Connect an RF power meter to the antenna connector.	26 W	MAIN	R79
FREQUENCY DEVIATION	1	• Operating channel : ch16 • Output power : Low • Connect an audio generator to J2 (pin 5) with an AC millivoltmeter and set as: Frequency : 1 kHz Level : 550 mV • Set an FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis : OFF Detector : (P–P)/2 • Transmitting	Rear Panel	Connect an FM deviation meter to the antenna connector through an attenuator.	±4.3 kHz	MAIN	R106

4-4 RECEIVER ADJUSTMENT

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY	1	• Operating channel : ch16 • [SQUELCH] control: Max. counterclockwise • Connect an SSG to the antenna connector and set as: Frequency : 156.800 MHz Level : 100 µV* (–67 dBm) Modulation : 1 kHz Deviation : ±3.5 kHz • Receiving	MAIN	Connect a DC voltmeter to the check point CP2.	Maximum voltage	MAIN	C10, C20, C26

*This output level of a standard signal generator (SSG) is indicated as SSG's open circuit.


DC power supply
13.8 V /15 A
to DC cable
Red
Black
R79
Output power adjustment
R106
Frequency deviation adjustment
C85
Reference frequency adjustment
CP2
Sensitivity check point
C10
C20
C26
Sensitivity adjustment
CP1
PLL lock voltage check point
L12
PLL lock voltage adjustment
J2
7
1
J2
②
⑥
⑤
④
Audio generator
300 Hz to 3 kHz
[PTT]
AC millivoltmeter
2–200 mV

SECTION 5 PARTS LIST

[LOGIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
IC1	1140008330	S.IC	µPD789406AGK-A03-9EU
IC2	1140005620	S.IC	X25080SI-2.7T6
IC3	1110004920	S.IC	S-80934ANMP-DDY
Q1	1590000660	S.TRANSISTOR	DTC144TU T107
Q2	1520000450	S.TRANSISTOR	2SB1132 T100 Q
Q3	1590000670	S.TRANSISTOR	FMW1 T148
D1	1750000020	S.DIODE	1SS184 (TE85R)
D2	1750000550	S.DIODE	1SS355 TE-17
D3	1750000020	S.DIODE	1SS184 (TE85R)
D4	1750000550	S.DIODE	1SS355 TE-17
D5	1750000020	S.DIODE	1SS184 (TE85R)
D6	1750000130	S.DIODE	DA204U T107
X1	6060000630	S.CERAMIC	PBRC 4.91 BR
R1	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R2	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R3	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R4	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R5	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R6	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R7	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R9	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R10	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R11	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R12	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R13	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R14	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R15	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R16	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R17	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R18	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R19	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R20	7030003250	S.RESISTOR	ERJ3GEYJ 270 V (27 Ω)
R21	7030003250	S.RESISTOR	ERJ3GEYJ 270 V (27 Ω)
R22	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R23	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R24	7030003650	S.RESISTOR	ERJ3GEYJ 563 V (56 kΩ)
R25	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R26	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R27	7030003510	S.RESISTOR	ERJ3GEYJ 392 V (3.9 kΩ)
R28	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)
R29	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R30	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
C1	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C2	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C3	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C4	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C5	4510007280	S.ELECTROLYTIC	50 CV 2R2 BS
C6	4030008890	S.CERAMIC	C1608 JB 1C 273K-T-A
C7	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C8	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C9	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C10	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C11	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C12	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C13	4510007280	S.ELECTROLYTIC	50 CV 2R2 BS
C14	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
J1	6510021720	S.CONNECTOR	30FLT-SM1-TB
J3	6510018960	S.CONNECTOR	B2B-PH-SM3-TB
DS1	5030001770	LCD	LM-1798B
DS2	5080000440	LAMP	BQ031-30118
DS3	5080000440	LAMP	BQ031-30118

[LOGIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
W3	8900005320	FFC	OPC-519
EP1	0910051452	PCB	B 5321B
EP2	8930045650	LCD CONTACT	SRCN-2040-SP-N-W

[VR-A UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R1	7210001500	VARIABLE	RK097111102AA (10KA)
W1	8900009060	CABLE	OPC-893
EP1	0910051461	PCB	B 5322A

[VR-B UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R1	7210001010	VARIABLE	RK097111000AA (10KB)
EP1	0910051470	PCB	B 5323

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
IC1	1110003640	S.IC	BA1604F-T
IC2	1110003200	S.IC	TA31136FN (EL)
IC3	1130007610	S.IC	µPD3140GS-E1 (DS8)
IC4	1150001540	IC	M57710-A/SC-1302
IC5	1110003750	S.IC	M5218AFP 600C
IC6	1180001070	S.IC	TA7805F (TE16L)
IC7	1110003090	IC	LA4425A
Q1	1580000540	S.FET	3SK131-T2-LA
Q2	1580000540	S.FET	3SK131-T2-LA
Q3	1530002360	S.TRANSISTOR	2SC2714-Y (TE85R)
Q4	1520000460	S.TRANSISTOR	2SB1132 T100 R
Q5	1590001190	S.TRANSISTOR	XP6501-(TX) .AB
Q6	1540000550	S.TRANSISTOR	2SD1664 T100Q
Q7	1560000270	S.FET	2SK302-Y (TE85R)
Q8	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
Q9	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
Q10	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
Q11	1530002240	S.TRANSISTOR	2SC3775-3-TB
Q12	1530003710	S.TRANSISTOR	2SC3268 (TE12L)
Q13	1560000540	S.FET	2SK880-Y (TE85R)
Q14	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q15	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q16	1520000380	TRANSISTOR	2SB1143 S
Q17	1590000670	S.TRANSISTOR	FMW1 T148
Q18	1590000460	S.TRANSISTOR	RN1402 (TE85R)
Q19	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q20	1520000460	S.TRANSISTOR	2SB1132 T100 R
Q21	1590000420	S.TRANSISTOR	RN1404 (TE85R)

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
Q22	1520000460	S.TRANSISTOR	2SB1132 T100 R
Q23	1530000160	S.TRANSISTOR	2SC2712-Y (TE85RTEM)
Q24	1590001390	S.FET	2SJ144-Y (TE85R)
Q25	1530000160	S.TRANSISTOR	2SC2712-Y (TE85RTEM)
D1	1710001080	DIODE	XB15A308
D2	1720000370	S.VARICAP	HVU350TRF
D3	1720000370	S.VARICAP	HVU350TRF
D4	1720000370	S.VARICAP	HVU350TRF
D5	1750000470	S.DIODE	1SS321 (TE85R)
D6	1790000540	S.VARICAP	MA338 (TX)
D7	1790000540	S.VARICAP	MA338 (TX)
D8	1790000620	S.DIODE	MA77 (TX)
D9	1750000060	S.DIODE	1SS196 (TE85R)
D11	1790000450	S.DIODE	MA862 (TX)
D12	1750000060	S.DIODE	1SS196 (TE85R)
D13	1790000690	S.DIODE	HSM88ASR-TR
D14	1790000690	S.DIODE	HSM88ASR-TR
D16	1750000130	S.DIODE	DA204U T107
D18	1790000700	DIODE	DSA3A1
D19	1710001080	DIODE	XB15A308
D20	1790000620	S.DIODE	MA77 (TX)
D21	1720000370	S.VARICAP	HVU350TRF
FI1	2010002420	MONOLITH	FL-310
FI2	2020001680	CERAMIC	ALFY450E
FI3	2010002420	MONOLITH	FL-310
X1	6070000210	S.DISCRIMINATOR	CDBCA450CX24
X2	6050010800	S.XTAL	CR-659 (21.25 MHz)
L1	6110001670	COIL	LA-253
L2	6110001600	COIL	LA-243
L3	6110001600	COIL	LA-243
L4	6200002370	S.COIL	LQN 1A 39NJ04
L5	6200008260	S.COIL	0.30-1.7-8TL 60N
L6	6200008260	S.COIL	0.30-1.7-8TL 60N
L7	6200002600	S.COIL	NL 252018T-047J
L8	6200002600	S.COIL	NL 252018T-047J
L9	6200003050	S.COIL	NL 322522T-R82J-3
L10	6200001980	S.COIL	NL 252018T-1R0J
L11	6200001980	S.COIL	NL 252018T-1R0J
L12	6130002360	S.COIL	LB-257
L13	6200001980	S.COIL	NL 252018T-1R0J
L14	6200001980	S.COIL	NL 252018T-1R0J
L15	6200001980	S.COIL	NL 252018T-1R0J
L16	6200004700	S.COIL	MLR1608M R10K-T
L17	6200004700	S.COIL	MLR1608M R10K-T
L18	6200004700	S.COIL	MLR1608M R10K-T
L19	6200002430	S.COIL	NL 252018T-082J
L20	6200002430	S.COIL	NL 252018T-082J
L21	6110001600	COIL	LA-243
L22	6170000230	COIL	LW-25
R1	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R2	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R3	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R4	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R5	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R6	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R7	7030003260	S.RESISTOR	ERJ3GEYJ 330 V (33 Ω)
R8	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R9	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R10	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R11	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R12	7030003790	S.RESISTOR	ERJ3GEYJ 824 V (820 kΩ)
R13	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R14	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R15	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R17	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R18	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R19	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R20	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R21	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R22	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R23	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R24	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R25	7030007590	S.RESISTOR	RR0816R-433-D (43 kΩ)
R26	7030003840	S.RESISTOR	ERJ3GEYJ 225 V (2.2 MΩ)
R27	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R28	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R29	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R30	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R31	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R32	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R33	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R34	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R35	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R36	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)
R37	7030003740	S.RESISTOR	ERJ3GEYJ 334 V (330 kΩ)
R38	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R39	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R40	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R41	7030003650	S.RESISTOR	ERJ3GEYJ 563 V (56 kΩ)
R42	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R43	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)
R44	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R45	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R46	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R47	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R48	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R49	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)
R50	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R51	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R52	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R53	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R54	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R55	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R56	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R57	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R58	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R59	7030003300	S.RESISTOR	ERJ3GEYJ 680 V (68 Ω)
R60	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R61	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R63	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R64	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R65	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R66	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R67	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R68	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R69	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R70	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R71	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R72	7030000960	S.RESISTOR	MCR18EZHJ 33 Ω (330)
R73	7030000960	S.RESISTOR	MCR18EZHJ 33 Ω (330)
R74	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R75	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R76	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R77	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R78	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R79	7310002670	S.TRIMMER	RV-143 (RH03A3AS2) 471
R80	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R81	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R82	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R83	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R84	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R85	7030000240	S.RESISTOR	MCR10EZHJ 68 Ω (680)
R86	7030000240	S.RESISTOR	MCR10EZHJ 68 Ω (680)
R87	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R88	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)
R89	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)
R90	7030003740	S.RESISTOR	ERJ3GEYJ 334 V (330 kΩ)
R91	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R92	7030003540	S.RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R94	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R95	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R98	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R99	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R100	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R101	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R102	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R103	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R104	7510000750	S.THERMISTOR	NTCCS2012 3NH 103KC-T
R105	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R106	7310002770	S.TRIMMER	RV-153 (RH03A3AN4X02A) 333
R107	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R108	7030003820	S.RESISTOR	ERJ3GEYJ 155 V (1.5 MΩ)
R109	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R110	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R111	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R112	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R113	7030000100	S.RESISTOR	MCR10EZHJ 4.7 Ω (4R7)
R114	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R115	7030003770	S.RESISTOR	ERJ3GEYJ 564 V (560 kΩ)
R116	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R117	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R118	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 kΩ)
R119	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R120	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R121	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R122	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R123	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R124	7030001070	S.RESISTOR	MCR50JZHJ 33 Ω (330)
R125	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R128	7030003590	S.RESISTOR	ERJ3GEYJ 183 V (18 kΩ)
R129	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
C1	4030011100	S.CERAMIC	GRM42-6 CH 080D 500PT
C2	4030011290	S.CERAMIC	GRM42-6 CH 240J 500PT
C3	4030011180	S.CERAMIC	GRM42-6 CH 220J 500PT
C5	4030011070	S.CERAMIC	GRM42-6 CH 050C 500PT
C6	4030011260	S.CERAMIC	GRM42-6 W5R 102K 500PT
C7	4030011190	S.CERAMIC	GRM42-6 CH 270J 500PT
C8	4030011220	S.CERAMIC	GRM42-6 CH 360J 500PT
C9	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C10	4610002150	S.TRIMMER	CTZ3S-10A-W1-AF
C11	4030006980	S.CERAMIC	C1608 CH 1H 070D-T-A
C13	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C14	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C15	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C16	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C17	4030009560	S.CERAMIC	C1608 CH 1H R75B-T-A
C18	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C19	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C20	4610002150	S.TRIMMER	CTZ3S-10A-W1-AF
C22	4030007020	S.CERAMIC	C1608 CH 1H 120J-T-A
C23	4030009560	S.CERAMIC	C1608 CH 1H R75B-T-A
C24	4030007020	S.CERAMIC	C1608 CH 1H 120J-T-A
C26	4610002150	S.TRIMMER	CTZ3S-10A-W1-AF
C27	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C28	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C29	4030006960	S.CERAMIC	C1608 CH 1H 050C-T-A
C30	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C31	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C32	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A
C33	4030007070	S.CERAMIC	C1608 CH 1H 330J-T-A
C34	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C35	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C36	4030007110	S.CERAMIC	C1608 CH 1H 680J-T-A
C39	4030008880	S.CERAMIC	C1608 JB 1C 223K-T-A
C40	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C41	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C42	4030008880	S.CERAMIC	C1608 JB 1C 223K-T-A
C43	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C44	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C45	4340000010	S.MYLAR	ECWU 1C 223JB5
C46	4550006150	S.TANTALUM	ECST1CY105R
C47	4550006170	S.TANTALUM	ECST1AY225R
C48	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C49	4510007310	S.ELECTROLYTIC	16 CV 10 BS
C50	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C51	4030009660	S.CERAMIC	C1608 JF 1C 224Z-T-A
C52	4030007130	S.CERAMIC	C1608 CH 1H 101J-T-A
C53	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C54	4030008680	S.CERAMIC	C2012 JF 1C 105Z-T-A
C55	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C56	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C57	4510007310	S.ELECTROLYTIC	16 CV 10 BS
C58	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C59	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C60	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C61	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C62	4030007160	S.CERAMIC	C1608 CH 1H 181J-T-A
C63	4030007160	S.CERAMIC	C1608 CH 1H 181J-T-A
C64	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C65	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C66	4550006150	S.TANTALUM	ECST1CY105R
C67	4550006170	S.TANTALUM	ECST1AY225R
C68	4550006360	S.TANTALUM	ECST1VY104R
C69	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
C70	4030007050	S.CERAMIC	C1608 CH 1H 220J-T-A
C71	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C72	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A
C73	4030007070	S.CERAMIC	C1608 CH 1H 330J-T-A
C74	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C75	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C76	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C77	4030009530	S.CERAMIC	C1608 CH 1H 030B-T-A
C78	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C79	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C80	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C81	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C82	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C83	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C84	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A
C85	4610002150	S.TRIMMER	CTZ3S-10A-W1-AF
C86	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A
C87	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C88	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C89	4030008880	S.CERAMIC	C1608 JB 1C 223K-T-A
C90	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C91	4030009560	S.CERAMIC	C1608 CH 1H R75B-T-A
C92	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C93	4030009920	S.CERAMIC	C1608 CH 1H 050B-T-A
C94	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C95	4030009990	S.CERAMIC	C1608 CH 1H 200J-T-A
C96	4030007020	S.CERAMIC	C1608 CH 1H 120J-T-A
C97	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C98	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C99	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A
C100	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C101	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C102	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C103	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C104	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A
C105	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C106	4030007040	S.CERAMIC	C1608 CH 1H 180J-T-A
C107	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C108	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C109	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C110	4030007020	S.CERAMIC	C1608 CH 1H 120J-T-A
C112	4550002830	S.TANTALUM	TESVD2 1V 685M-12R
C113	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C114	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C115	4510004590	ELECTROLYTIC	16 MV 470 HC
C116	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C117	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C118	4510007300	S.ELECTROLYTIC	50 CV 1 BS
C120	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C121	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C122	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C123	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C124	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C125	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C126	4030011170	S.CERAMIC	GRM42-6 CH 180J 500PT
C127	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C128	4030011290	S.CERAMIC	GRM42-6 CH 240J 500PT
C129	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C130	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C131	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C132	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C133	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C134	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C135	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C136	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C137	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C138	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C139	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C140	4510007310	S.ELECTROLYTIC	16 CV 10 BS
C141	4550006150	S.TANTALUM	ECST1CY105R
C143	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C144	4030008770	S.CERAMIC	C1608 JB 1H 562K-T-A
C145	4030007090	S.CERAMIC	C1608 CH 1H 470J-T-A
C147	4510004630	S.ELECTROLYTIC	ECEV1CA100SR
C148	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C149	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C150	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C151	4510007280	S.ELECTROLYTIC	50 CV 2R2 BS
C152	4510007280	S.ELECTROLYTIC	50 CV 2R2 BS
C153	4510007280	S.ELECTROLYTIC	50 CV 2R2 BS
C154	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C155	4510004590	ELECTROLYTIC	16 MV 470 HC

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
C156	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C157	4510004590	ELECTROLYTIC	16 MV 470 HC
C158	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C159	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C160	4510007290	S.ELECTROLYTIC	6 CV 100 BS
C161	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C162	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C163	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C164	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C165	4510007310	S.ELECTROLYTIC	16 CV 10 BS
C166	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C167	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C168	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C169	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C170	4030012600	S.CERAMIC	C2012 JB 1A 105M-T-A
C171	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C172	4550006130	S.TANTALUM	ECST1VY224R
C173	4550006150	S.TANTALUM	ECST1CY105R
C174	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C176	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C177	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C178	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C179	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C180	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C181	4030008890	S.CERAMIC	C1608 JB 1C 273K-T-A
C182	4030008890	S.CERAMIC	C1608 JB 1C 273K-T-A
C183	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C184	4030006970	S.CERAMIC	C1608 CH 1H 060D-T-A
C189	4030007030	S.CERAMIC	C1608 CH 1H 150J-T-A
J1	6510019420	S.CONNECTOR	B8B-ZR-SM3-TF
J2	6510003430	CONNECTOR	B07B-EH-S
J3	6450001060	CONNECTOR	HSJ1493-01-010
J4	6510021720	S.CONNECTOR	30FLT-SM1-TB
W1	7030003970	S.JUMPER	MCR18EZHJ JPW (000)
EP1	0910051442	PCB	B 5320B

S.=Surface mount

SECTION 6 MECHANICAL PARTS AND DISASSEMBLY

6-1 CABINET PARTS

[CHASSIS PARTS]

REF. NO.	ORDER NO.	DESCRIPTION		QTY.
J1	6510004880	Antena connector MR-DES-01		1
MC1	Optional product	Microphone HM-124B	[BLACK]	1
	Optional product	Microphone HM-124W	[WHITE]	1
SP1	2510001040	Speaker F45G07-4		1
W1	8900009050	Cable OPC-892		1
MP2	8010017263	2040 Chassis-3		1
MP3	8930045700	2040 IC clip		1
MP4	8510011530	2040 Case	[BLACK]	1
	8510011550	2040 Case (A)	[WHITE]	1
MP5	8210015210	2040 Front panel	[BLACK]	1
	8210015260	2040 Front panel (A)	[WHITE]	1
MP6	8930045260	2040 6-key		1
MP7	8930045270	2040 R-packing		1
MP8	8930045280	2040 F-packing		1
MP10	8610010550	Knob N-264	[BLACK]	2
	8610010580	Knob N-264 (A)	[WHITE]	2
MP12	8930033470	1542 Jack bush		1
MP13	8930045290	2040 Bush plate		1
MP16	8810008630	Screw PH B0 M3x6 NI-ZU (BT)		7
MP17	8810008660	Screw PH B0 M3x8 NI-ZU (BT)		4
MP18	8810008660	Screw PH B0 M3x8 NI-ZU (BT)		2
MP19	8810004540	Screw BiH M3x8 SUS		2
MP20	8810004540	Screw BiH M3x8 SUS		4
MP21	8810008680	Screw PH M3x8 NI		4

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
DS1	5030001373	LCD LD-HU4549J-1	1
DS2	5080000440	Lamp BQ031-30118	1
DS3	5080000440	Lamp BQ031-30118	1
W3	8900005320	Cable OPC-519	1
EP2	8930045650	LCD contact SRCN-2040-SP-N-W	1
MP1	8210015200	2040 Reflector	1
MP2	8930045300	2040 LCD holder	1

[VR-A UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7210001500	Variable resistor RK097111102AA (10KA) [PWR/VOL] (incl. nut)	1

[VR-B UNIT]

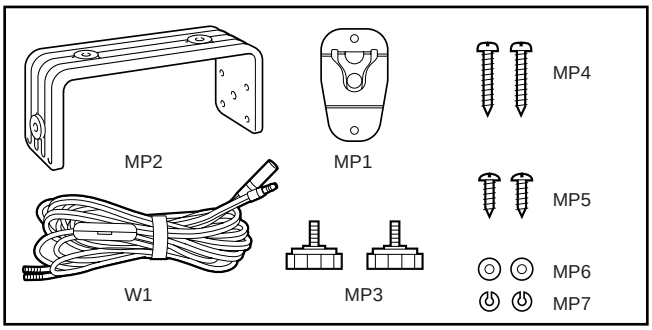
REF. NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7210001010	Variable resistor RK097111000AA (10KB) [SQUELCH] (incl. nut)	1

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
IC4	1150001540	SC-1302	1
MP2	8510011690	2040 Module plate	1

[ACCESSORIES]

REF. NO.	ORDER NO.	DESCRIPTION		QTY.
W1	8900009040	Cable OPC-891		1
MP1	8950005110	2289 MIC hanger		1
MP2	8010017250	2040 Mobile bracket	[BLACK]	1
	8010017270	2040 Mobile bracket (A)	[WHITE]	1
MP3	8610010560	2040 Knob bolt	[BLACK]	2
	8610010590	2040 Knob bolt (A)	[WHITE]	2
MP4	8810004770	Screw PH A0 M3.0x16 SUS		2
MP5	8810001490	Screw PH A0 M5x20 SUS		2
MP6	8850000180	Flat washer M5 SUS		2
MP7	8850000500	Spring washer M5 SUS		2



Screw abbreviations

A, B0, BT: Self-tapping
PH: Pan head
FH: Flat head
BiH: Bind head
NI: Nickel
SUS: Stainless
ZK: Black

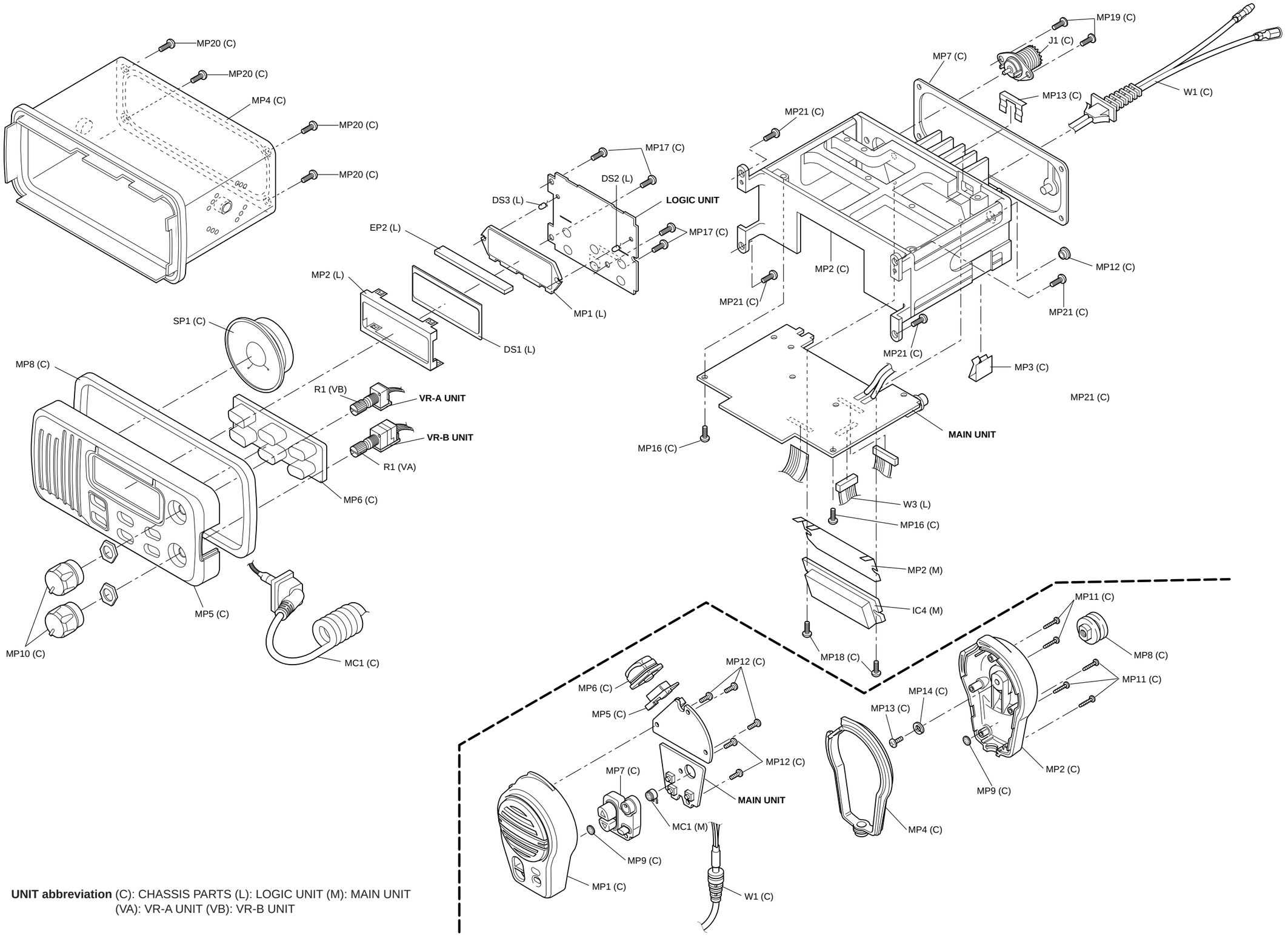
6-2 MICROPHONE PARTS

[CHASSIS PARTS]

REF. NO.	ORDER NO.	DESCRIPTION		QTY.
MP1	8210013600	1823 Front panel	[BLACK]	1
	8210013590	1823 Front panel (A)	[WHITE]	1
MP2	8210013620	Rear panel	[BLACK]	1
	8210013610	Rear panel (A)	[WHITE]	1
MP4	8930039780	1823 Seal		1
MP5	8930039750	1823 PTT holder		1
MP6	8930039760	1823 PTT rubber		1
MP7	8930039730	1823 Key board		1
MP8	8930039720	1823 Hanger knob		1
MP9	8930039740	1823 M-sheet		2
MP11	8810009250	Screw B0 2.6x16 SUS		5
MP12	8810009260	Screw B0 2.0x6 NI (BT)		5
MP13	8810009240	Screw Bih M4x10 ZK		1
MP14	8850001610	Spring washer M4 SUS		1
W1	8900009070	OPC-894	[BLACK]	1
	8900009080	OPC-895	[WHITE]	1

[MAIN UNIT]

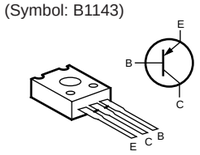
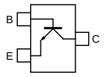
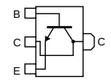
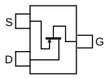
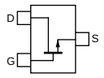
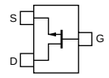
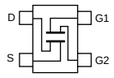
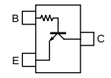
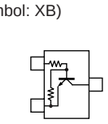
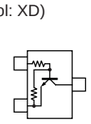
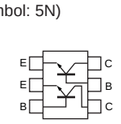
REF. NO.	ORDER NO.	DESCRIPTION	QTY.
MC1	7700001600	KUC 2123-030245	1



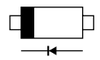
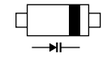
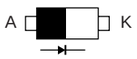
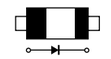
UNIT abbreviation (C): CHASSIS PARTS (L): LOGIC UNIT (M): MAIN UNIT
(VA): VR-A UNIT (VB): VR-B UNIT

SECTION 7 SEMI-CONDUCTOR INFORMATION

• TRANSISTOR AND FET'S

2SB1132 Q (Symbol: BAQ) 	**2SB1132 R** (Symbol: BAR) 	**2SB1143 S** (Symbol: B1143) 	**2SC2712 Y** (Symbol: LY) 	**2SC2714 Y** (Symbol: QY) 
2SC3268 (Symbol: ME) 	**2SC3775 3** (Symbol: OY3) 	**2SC4215 O** (Symbol: QO) 	**2SD1664 Q** (Symbol: DAQ) 	**2SJ144 Y** (Symbol: VY) 
2SK302 Y (Symbol: TY) 	**2SK880 Y** (Symbol: XY) 	**3SK131 L** (Symbol: V12) 	**DTC144 TU** (Symbol: 06) 	**FMW1** (Symbol: W1)
RN1402 (Symbol: XB) 	**RN1404** (Symbol: XD) 	**XP6501 AB** (Symbol: 5N) 		

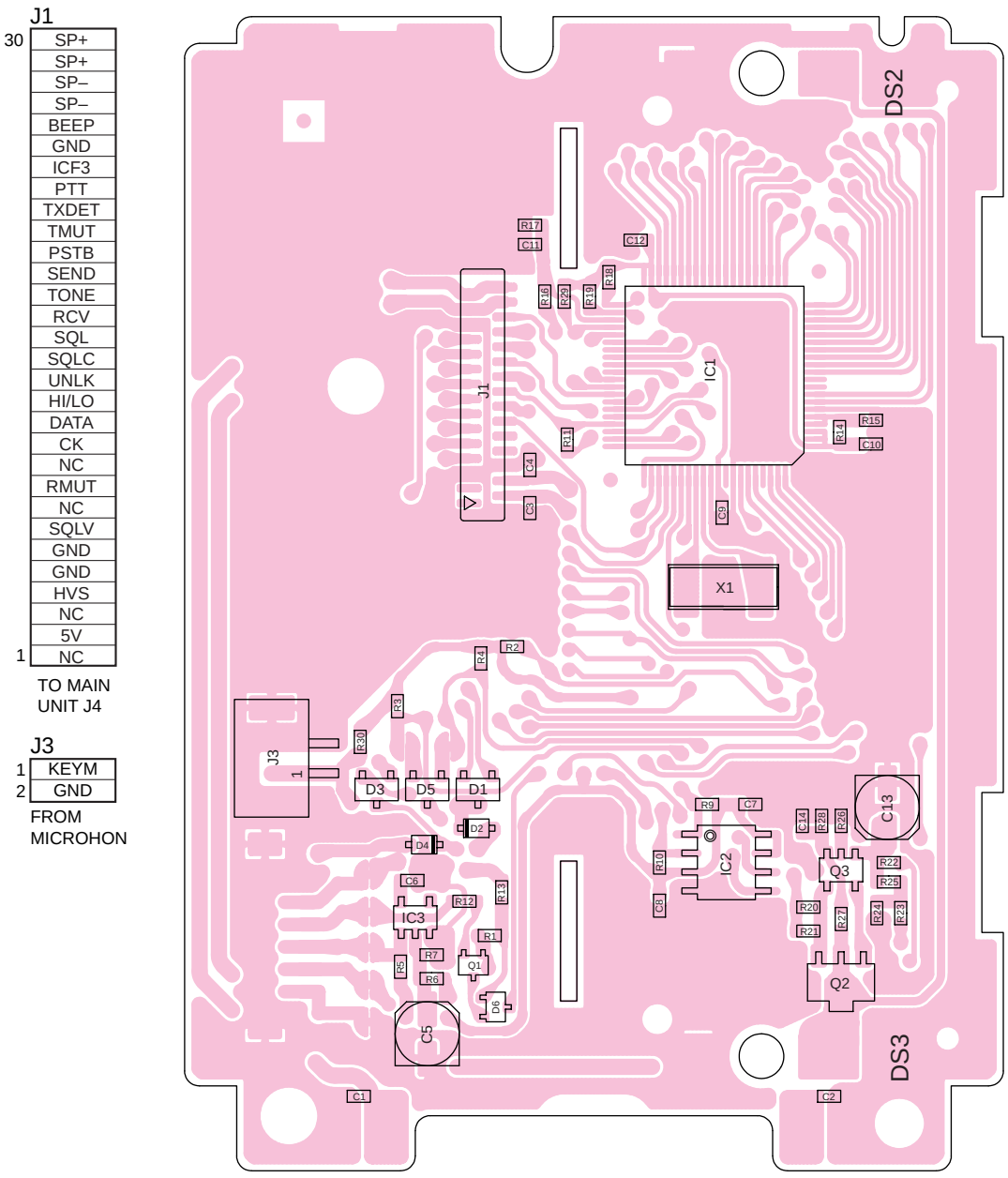
• DIODES

1SS184 (Symbol: B3) 	**1SS196** (Symbol: G3) 	**1SS321** (Symbol: F9) 	**1SS355** (Symbol: A) 	**DA204 U** (Symbol: K)
HSM88ASR (Symbol: C3) 	**HVU350** (Symbol: 4) 	**MA77** (Symbol: 4B) 	**MA338** (Symbol: 6H) 	**MA862** (Symbol: M1l)

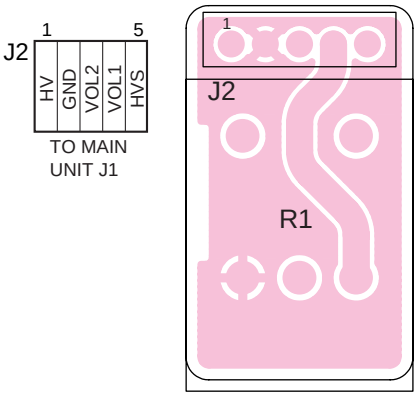
SECTION 8 BOARD LAYOUTS

8-1 LOGIC UNIT

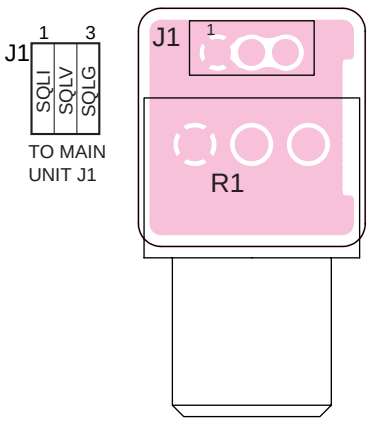
● **TOP VIEW**



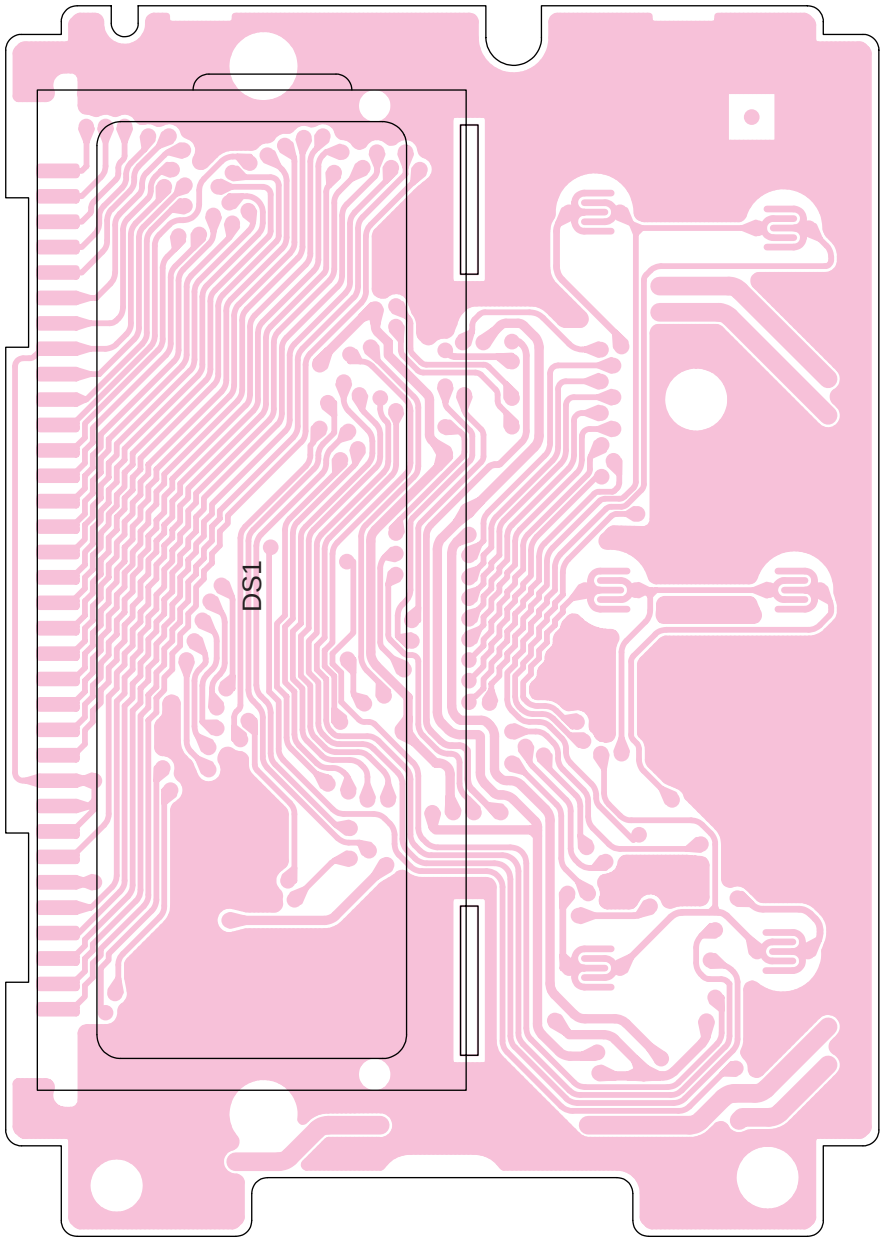
● VR-A UNIT



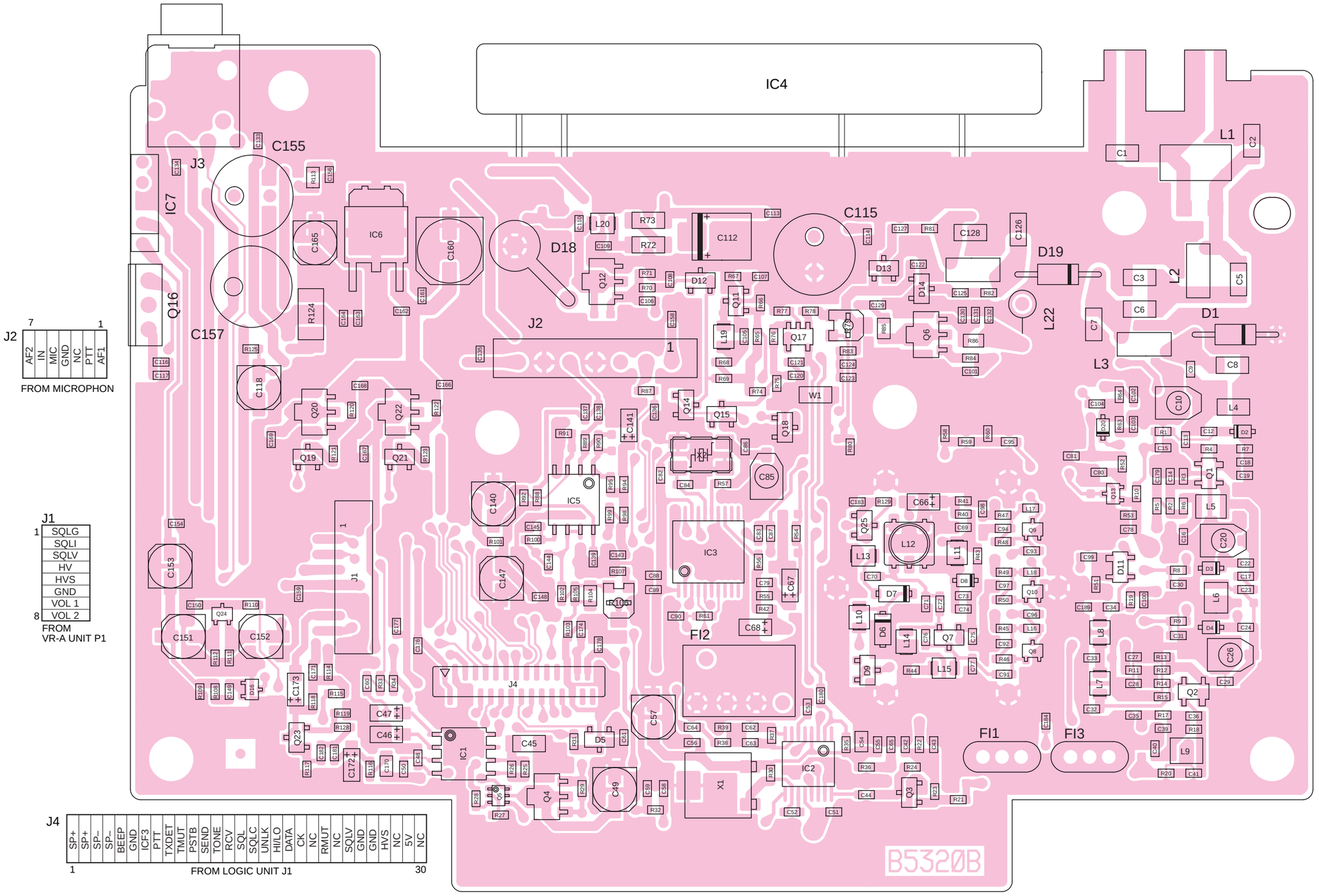
● VR-B UNIT



● **BOTTOM VIEW**



8-2 MAIN UNIT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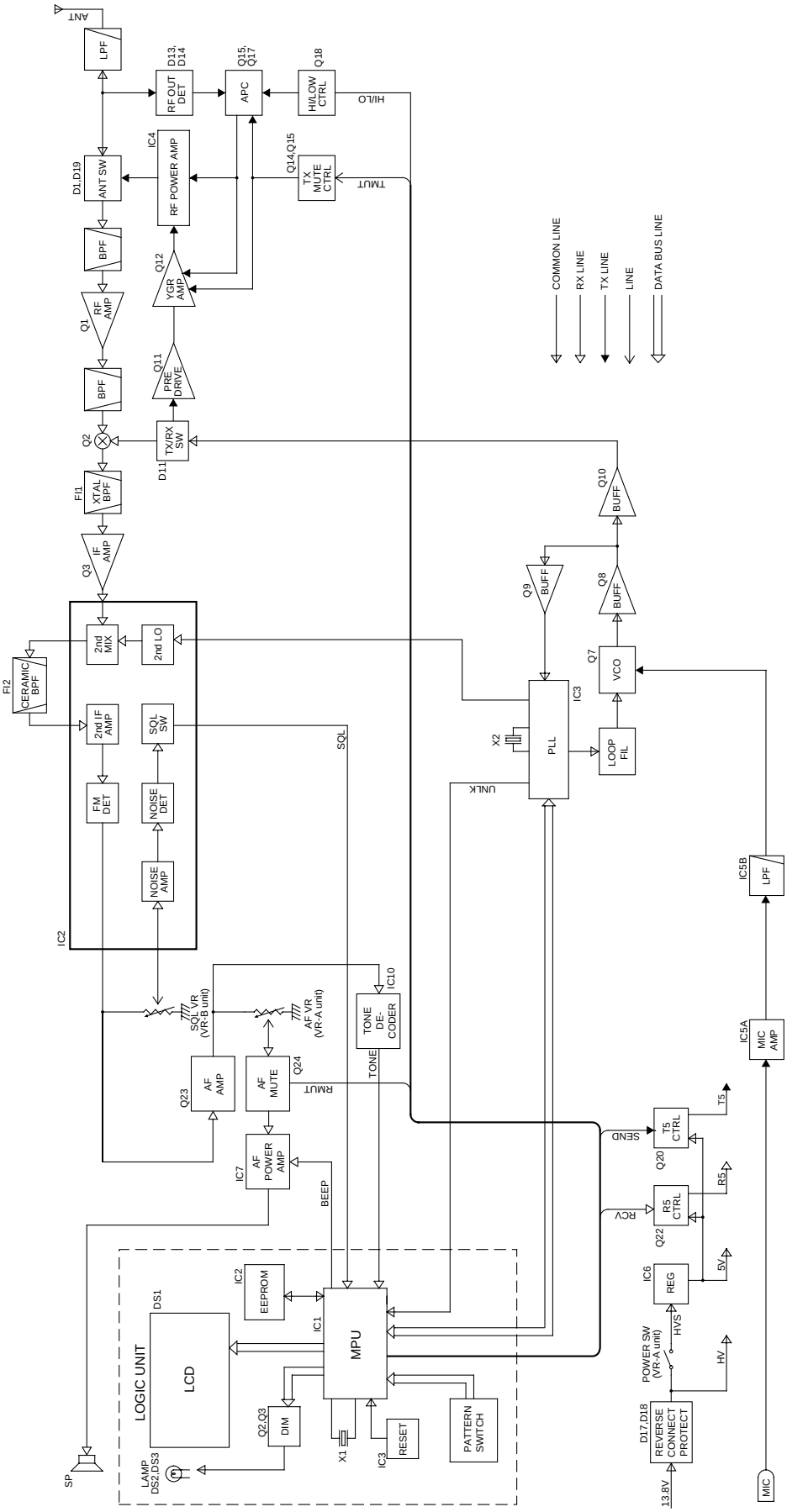
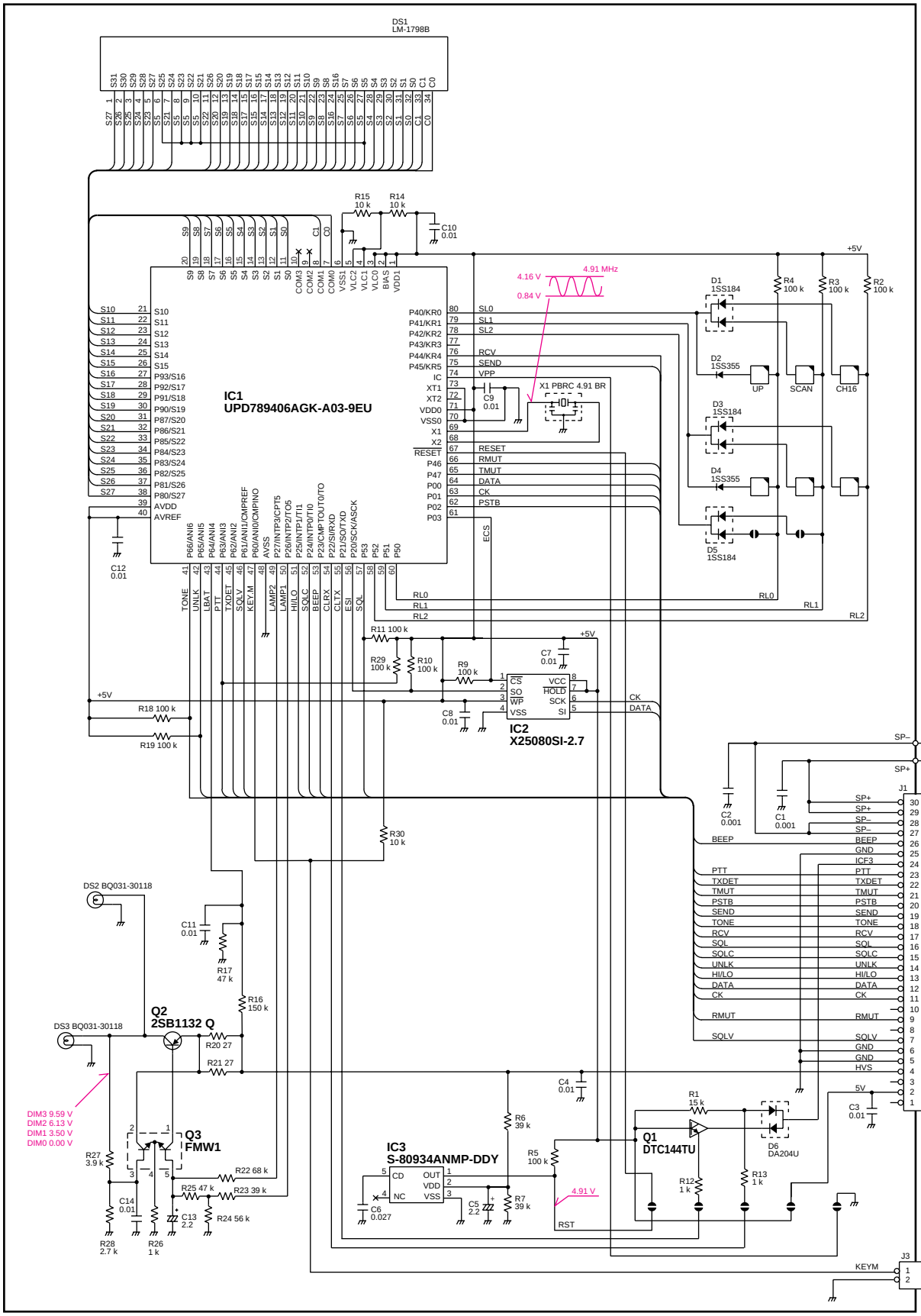
SECTION 9 BLOCK DIAGRAM

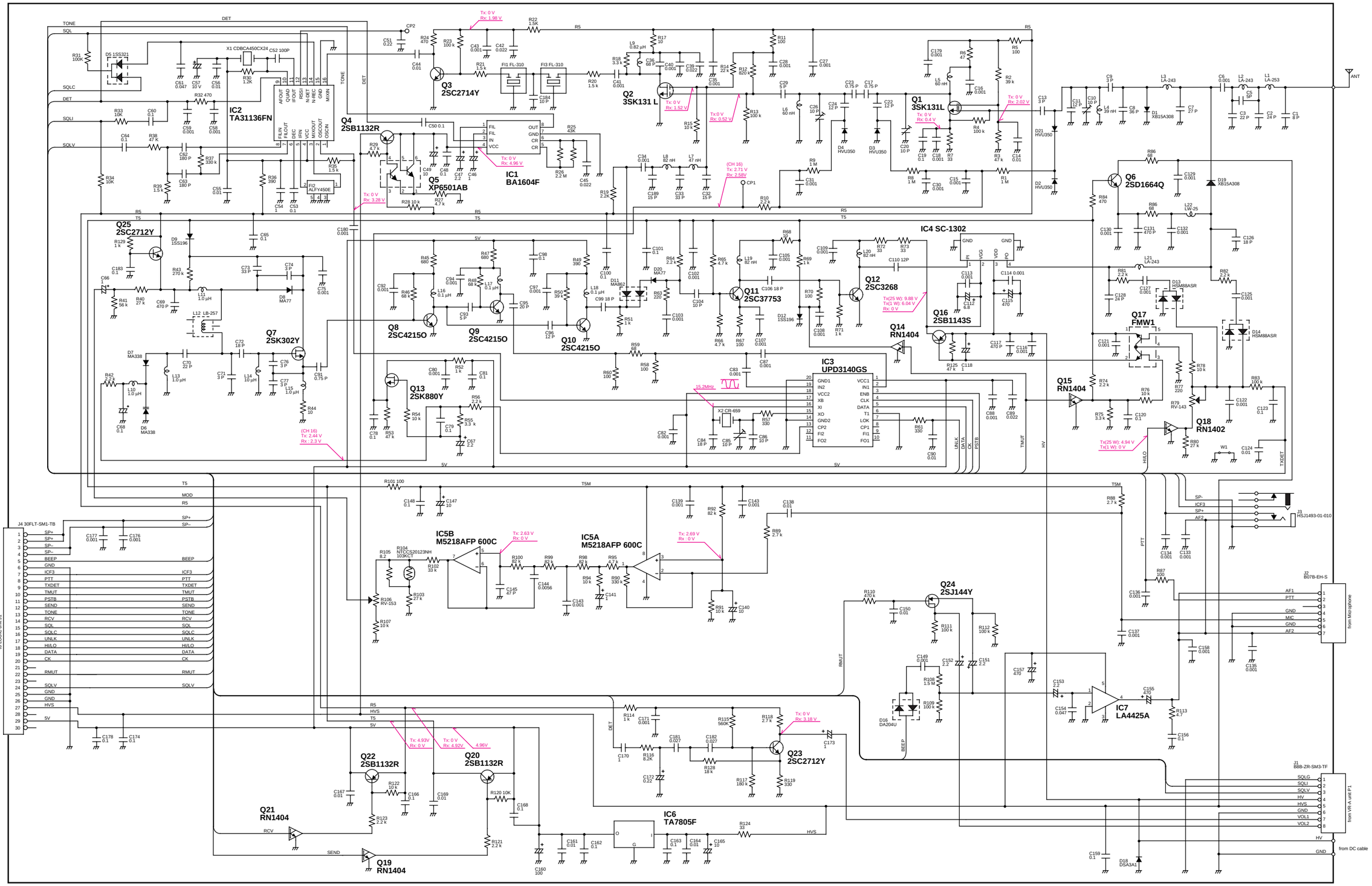


SECTION 10 VOLTAGE DIAGRAM

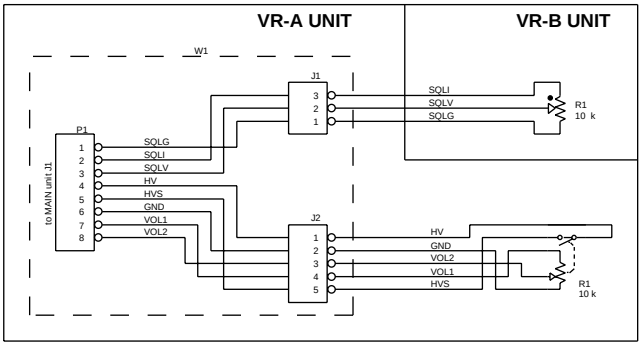
10-1 LOGIC UNIT



10-2 MAIN UNIT



10-3 VR-A AND VR-B UNITS



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